WHAT IS CLAIMED IS:

1. A method for configuring a preamble of a downlink frame for synchronization and channel estimation in a wireless local area network system, the method comprising:

a) arranging a short preamble, used for time and frequency synchronization in a receiver, at starting points of an uplink burst and a downlink burst, wherein arranging the short preamble comprises

repetitively arranging a plurality of S symbols in the starting points of the uplink burst and the downlink burst, and

arranging an IS symbol after the S symbols; and

b) arranging a long preamble used for fine frequency offset estimation and channel estimation in the receiver after the short preamble, wherein arranging the long preamble comprises

arranging a long cyclic prefix (CP) after the short preamble, and

repetitively arranging a plurality of L symbols after the long CP.

2. The method of claim 1, wherein in a), the S symbol is repeated 16 times within a data symbol period, and the IS symbol has the length of a guard interval and is 180°-phased with respect to the S symbol.

3. The method of claim 1, wherein a frequency domain signal SP_k of the short preamble is given as the following Equation:

$$SP_k = \begin{cases} \sqrt{200/24} \times \left(C^4_{1,m+1} + jC^4_{8,m+1}\right), & k = 16 \times m, 0 \le m < 6 \\ \sqrt{200/24} \times \left(C^4_{1,m+1} + jC^4_{8,m+1}\right), & k = 16 \times (m+1) + 4, 6 \le m \le 11 \\ 0, & otherwise \end{cases}$$

where $\sqrt{200/24}$ is a normalized power value resulted from using 12 sub-carriers among 200 sub-carriers, $C^4_{s,m}$ is calculated by inverting 0 into -1 in a matrix generated by an m-sequence generator of a fourth-degree polynomial $x^4 + x + 1$, and s is an initial value.

4. The method of claim 3, wherein a time domain signal of the short preamble is formed by adding the IS symbol to a signal which is an Inverse Fast Fourier Transform (IFFT) processed frequency domain signal SP_k.

5. The method of claim 1, wherein in b), the L symbols respectively have the length of the data symbol period and are repeated twice, and wherein the length of the long CP is twice as long as that of the guard interval.

6. The method of claim 1, wherein a frequency domain signal LP_k of the long preamble is given as the following Equation:

$$LP_k = \begin{cases} C^8_{1,m+11}, & if\ k \ne 100 \\ 0, & if\ k = 100 \end{cases}, \quad 0 \le k < 200$$

where $C^8_{s,m}$ is calculated by inverting 0 into -1 in a matrix generated from an m-sequence generator of an eight-degree polynomial

$x^8+x^7+x^6+x+1$, and s denotes an initial value.

7. The method of claim 6, wherein a time domain signal of the long preamble is formed by repeating a signal twice and inserting the long CP having a length twice as long as that of the CP, the signal being formed by IFFT processing the frequency domain signal LP_k.

8. The method of claim 1, wherein parameters of the preamble comprise a physical layer convergence protocol preamble (PLCP) period, a cyclic prefix period, a short train sequence period, and a long train sequence period.

9. The method of claim 8, wherein, when the preamble is provided in a time domain of a 60GHz wireless local area network, the PLCP preamble period is set to be 6.8μs, the cyclic prefix period is set to be 0.133μs, the short train sequence period is set to be 2.27μs, and the long train sequence period is set to be 4.53μs.

10. A method for detecting synchronization of data transmitted per frame in a wireless local area network system,

wherein the frame comprises a short preamble having a plurality of repetitive S symbols, and an IS symbol,

the method comprising:

a) detecting frame synchronization of a short preamble in a form of a periodically repeated signal according to a characteristic of auto-correlation of the short preamble; and

b) estimating timing by performing auto-correlation according to windows having lengths set to have different periods.

11. The method of claim 10, wherein in a), amplitude and phase of the window of the auto-correlation are both used for detecting the frame synchronization.

12. The method of claim 10, wherein a) comprises:

i) delaying the short preamble by an auto-correlation delay;

ii) calculating an average value by multiplying a conjugate complex value of the delayed signal by a received signal;

iii) calculating an average value by squaring the delayed signal in i); and

iv) calculating an auto-correlation value based on the average value calculated in ii) and the average value calculated in iii).

13. The method of claim 12, wherein the auto-correlation value $\hat{\tau}_n$ is calculated by the following Equation:

$$\hat{\tau}_n = \frac{\left| \sum_{i=0}^{N_{WS}-1} y_{k-i} y^*_{k-N_{Delay}-i} \right|}{\sum_{i=0}^{N_{WS}-1} \left| y^*_{k-N_{Delay}-i} \right|^2}$$

where y_{k-i} is a received signal, $y^*_{k-N_{Delay}}$ is a signal that is delayed by N_{Delay} samples and is then converted into a conjugate complex.

14. The method of claim 13, wherein in ii), the multiplied value is stored in a shift register having a predetermined window length.

15. The method of claim 12, wherein in b), the highest peak of auto-correlation is found within a period of the predetermined window length to detect timing.

16. The method of claim 10, wherein in b), when the CP is inserted instead of inserting the IS symbol, the length of the window of the auto-correlation is set to be within 16 samples, and a detecting range in the frame synchronization is set to be ±8 samples from a start point of the preamble.

17. The method of claim 12, wherein, for confirming the auto-correlation value calculated in iv), a) further comprises:

v) delaying the short preamble by a sum of the auto-correlation delay and a certain confirmation delay;

vi) calculating an average value by multiplying the received signal by a conjugate complex of the delayed signal;

vii) calculating an average value by squaring the delayed signal in v); and

viii) calculating a confirmation-correlation value based on the average value calculated in vi) and the average value calculated in vii) to confirm the auto-correlation value.

18. The method of claim 17, wherein the confirmation-correlation

value is obtained by the following Equation:

$$\hat{\tau}_{n-confirm} = \frac{\left| \sum_{i=0}^{N_{WS}-1} y_{k-i} \cdot y^{*}_{k-N_{Delay}-N_{confirm}-i} \right|}{\sum_{i=0}^{N_{WS}-1} \left| y^{*}_{k-N_{Delay}-N_{confirm}-i} \right|^{2}}$$

where $y^{*}_{k-N_{Delay}-N_{confirm}}$ is a signal generated by delaying a received signal by total samples of the auto-correlation delay N_{Delay} and the certain confirmation delay $N_{confirm}$, and then complex-conjugating the delayed signal.

19. The method of claim 18, wherein a starting point of the frame is found by using a window of auto-correlation, the length of the window being set to be N samples, and the highest peak is found within the N samples at a detecting point to increase timing accuracy within ± 8 samples.